Endangered Species Act
Section 7 Consultation

BIOLOGICAL OPINION

Issuance of a Section 10(a)(1)(B) Incidental Take Permit for Recreational Fishery Programs Conducted in the Columbia River Basin Above Priest Rapids Dam by the Washington Department of Fish and Wildlife

Consultation Conducted By: National Marine Fisheries Service,
Northwest Region
Tracking Number F/NWR/2000/00995

Approved: _____
for Donald R. Knowles
Director, Office of Protected Resources

Date: 12-22-00

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I. Consultation History

Under section 10(a)(1)(B) of the Endangered Species Act (ESA), non-Federal entities may apply for permits from the National Marine Fisheries Service (NMFS) to incidentally take ESA-listed species under the jurisdiction of NMFS if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the ESA, the permit shall be issued if NMFS finds: (1) the taking will be incidental; (2) the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking; (3) the applicant will ensure that adequate funding for the conservation plan will be provided; (4) the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and (5) any other measures that the Secretary may require as being necessary or appropriate will be met.

In August of 1997, the NMFS listed Upper Columbia River steelhead Evolutionarily Significant Unit (ESU) as endangered, pursuant to the ESA (62 FR 43937). The Upper Columbia River spring chinook salmon ESU was listed as endangered on May 24, 1999 (65 FR 14308). Critical habitat for these ESUs was designated on February 16, 2000 (65 FR 7764). Bull trout in the Columbia River Basin are also listed as threatened (64 FR 58909; November 1, 1999). Bull trout are under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS).

In response to the salmon and steelhead listings and in accordance with section 10(a)(1)(B) of the ESA, the Washington Department of Fish and Wildlife (WDFW) applied for a five-year incidental take permit for annual incidental takes of listed Upper Columbia River steelhead and spring chinook associated with the State of Washington's recreational fishing program (application dated March 13, 2000; WDFW 2000). These recreational fisheries include fisheries targeting non-listed resident fish species, and non-listed chinook salmon.

NMFS has completed an Environmental Assessment under the National Environmental Policy Act (NEPA) for the action of potentially issuing a section 10 permit under the ESA. The EA and section 10 permit application have been subject to public review and comment for a period of 30 days (65 FR 20952; April 19, 2000). No comments were received on the EA or permit application.

On April 19, 2000, NMFS sent a letter to the USFWS requesting concurrence on the determination that issuing the permit to WDFW is not likely to adversely affect listed bull trout in the Upper Columbia Region. In a letter dated June 5, 2000, the USFWS concurred with NMFS' determination (Martin 2000).

II. Proposed Action

On March 13, 2000, the WDFW submitted an application to NMFS for an ESA section 10(a)(1)(B) permit for an incidental take of ESA-listed anadromous fish species associated with seven recreational fishery programs to be conducted above Priest Rapids Dam on the Columbia River and its tributaries from 2000 to 2004. Table 1 lists the proposed fisheries. The fisheries are fully described in the permit application (WDFW 2000). The fisheries target resident trout, smallmouth bass, walleye, sturgeon, whitefish, summer/fall chinook and non-listed chinook salmon.

Action Area. The activities considered in this biological opinion include specific areas upstream of Priest Rapids Dam on the Upper Columbia River and its tributaries. These areas, and the fisheries proposed are described in Table 1. The action area considered in a biological opinion must include all areas affected directly or indirectly by the proposed activities, not merely the immediate area involved in the action [50 CFR §402.02]. Therefore, the action area for this consultation includes the range of listed salmon and steelhead directly and indirectly affected by hatchery operations and includes the spawning/nursery areas, the Columbia River migration corridors, the Columbia River estuary, and ocean habitats.

Table 1. Fishery activities proposed to occur in specific areas upstream of Priest Rapids Dam on the Upper Columbia River and its tributaries from 2000 to 2004 considered in this Opinion. Specific locations of the fisheries are further described in the text.

Fishery	Location
Rainbow, cutthroat, and brook trout recreational fishery	Methow River and two tributaries
Summer/Fall chinook recreational fishery [1]	Mainstem Columbia R.
Leavenworth Hatchery spring chinook fishery [1]	Icicle Creek (Wenatchee subbasin)
Smallmouth bass recreational fisheries [1,2]	Mainstem Columbia R. and Okanogan R.
Walleye recreational fisheries [1,2]	Mainstem Columbia R. and Okanogan R.
Sturgeon recreational fishery [1,2]	Mainstem Columbia R.
Whitefish recreational fishery [1]	Chewuch R., Methow R., Similkameen R., Entiat R., Wenatchee R.[3]

[1] No anticipated impacts to ESA-listed spring chinook salmon.
[2] No anticipated impacts to ESA-listed summer steelhead.
[3] All rivers listed are only open in specific areas and during specific time periods.

A. Proposed Fisheries

The vast majority of stream miles (>90%) in the Upper Columbia River region have been closed to fishing because of recent ESA listings or to protect indigenous stocks (WDFW 2000). The fisheries detailed below occur in areas where significant populations of resident species or unlisted salmon are known to occur. Potential effects of the fisheries to listed fish would be from incidental take primarily associated with catch-and-release handling. No harvest (i.e. retained by the angler) of listed fish is expected to result, except for the potential incidental harvest of unmarked, listed spring chinook in the Leavenworth Hatchery spring chinook fishery.

Methow River Rainbow, Cutthroat, and Brook Trout Recreational Fishery

This fishery is scheduled to occur June 1 through September 30 in the mainstem Methow River, and two of its tributaries, the Chewuch and Twisp rivers. However, due to stream runoff, angling typically occurs after the first part of July. The specific areas open are the mainstem Methow River from Gold Creek (at river mile (RM) 21.6) to the Weeman Bridge (RM 60.1, approximately eight miles upstream of Winthrop, Washington), the Chewuch River from its mouth (at Methow RM 50.1) 11.4 miles upstream to the mouth of Eight Mile Creek, and the Twisp River from its mouth (at Methow RM 40.2) to the mouth of War Creek (16.2 miles upstream). The regulations for this fishery are catch-and-release of trout only using unscented, artificial flies and lures with single, barbless hooks. The use of bait is prohibited.

This fishery targets the resident populations of trout that reside in the Methow River Basin. Any impacts to listed spring chinook and steelhead would be from mortality associated with incidentally catching and releasing listed fish. The exact number of listed fish that may be intercepted in the fishery is unquantified primarily due to two factors: 1) uncertainty about the amount of effort, due to the significant regulation changes that will be in place this year and the loss of angling opportunity throughout the entire Upper Columbia Basin, and 2) because the proportion of total *O. mykiss* population originating from listed anadromous parents caught in the fishery is unknown. The overall mortality occurring in this fishery is likely to be negligible in terms of adult equivalents.

In the permit application a research study was proposed to determine the proportion of juvenile *O. mykiss* caught in the Methow River trout fishery that originated from anadromous parents. This study involved the lethal take of *O. mykiss* in order to analyze the fishes' otolith. WDFW decided not to conduct the research study at this time. Instead, a creel survey will be conducted on the Methow River to determine the species composition, number of fish caught, and size of fish caught. This information will be used to determine how likely it is that juvenile steelhead are predominant in the catch. If it is determined that further investigations are warranted to quantify the proportion of anadromous *O. mykiss* caught in this fishery using otolith analysis, WDFW will apply for a section 10(a)(1)(A) research and enhancement permit in the future.

Mainstem Columbia River Summer/Fall Chinook Recreational Fishery

Summer/fall chinook in the Upper Columbia River region are not listed under the ESA. The proposed regulations would open the Upper Columbia River mainstem to angling for summer/fall chinook between August 1 and October 31. Most of the angling occurs only until the middle of October. The regulations for this fishery are 2 adult salmon per day. The fishery occurs primarily at the mouth of the Wenatchee River (Columbia RM 468.4) and below the tailrace of Rocky Reach Dam (RM 474.5). Overall effort is estimated to be about 25 to 50 anglers in about 20 boats per day (WDFW 2000). Some angling from the bank occurs. The fishing tackle typically used in this fishery includes spinners, spoons, plugs, and natural bait such as roe and herring. Because of the size of the fish, large hooks are typically used.

Leavenworth Hatchery Spring Chinook Recreational Fishery

Spring chinook returning to Leavenworth Hatchery are not indigenous to the ESU and were not included as part of the listed ESU. Inseason run abundance of hatchery and wild spring chinook returning to the Upper Columbia River determines if and when the harvest of hatchery chinook will be allowed. The seasons, limits, and gear restrictions for this fishery are announced in late April. This fishery typically occurs in May and June on hatchery fish returning to Leavenworth Hatchery. Angling is allowed only from the mouth of Icicle Creek (which flows into the Wenatchee River at RM 25.6) upstream to 400 feet below the Leavenworth Hatchery adult collection facility, a distance of approximately 2½ miles.

Smallmouth Bass Recreational Fisheries

This fishery is open year round under permanent state regulations in the mainstem Columbia River and Okanogan River below Malott Bridge. However, most angling occurs after spring runoff (July through September) when streamflows and warmer water permit successful angling. Anglers typically use buoyant plugs and soft bodied jigs. The daily limit is five bass of which no more than 3 can be over 15 inches in length. Angling effort is estimated to be approximately 500 to 600 angler days. Smallmouth bass are not native to the state of Washington.

Walleye Recreational Fisheries

The walleye fishery is open year round under permanent state regulations in the mainstem Columbia River, with most angling occurring between January and April, when fish aggregate prior to spawning. The daily limit is 5 fish with a minimum size of 18 inches and not more than one over 24 inches. Effort is estimated to be about 300-400 angler days, with most of the fishing occurring below the tailraces of the mainstem Columbia River dams. Fishing tackle typically includes soft body grubs, buoyant plugs, and spinner baits. Walleye are not native to the state of Washington.

Sturgeon Recreational Fishery

A year round, catch-and-release only, sturgeon fishery occurs under permanent state regulations in the mainstem Columbia River. Limited angling occurs in the mainstem river above Priest Rapids Dam using very large hooks (>4/0) with bait. Fishing primarily occurs in deep water areas.

Whitefish Recreational Fishery

This fishery is proposed to occur from December 1 through March 31[1] of each year. The daily limit is 15 fish with no minimum size restriction. Use of bait is allowed if hooks are size #14 (3/16 inch hook gap size) or smaller. Fishing is limited to the following specific locations: Chewuch River from the mouth to the Pasayten Wilderness boundary (RM 33.3), the Methow River from the mouth to the falls above Brush Creek, Similkameen River from the mouth to the Canadian border (RM 9), Entiat River from the mouth to Entiat Falls (RM 33.7), and the Wenatchee River from the mouth to Highway 2 bridge at Leavenworth (RM 24). Effort in this fishery is roughly estimated to be about 250 angler days.

Other Gamefish and Non-gamefish Recreational Fisheries

In addition to the fish species listed above, over 20 other species (such as Northern pikeminnow) may be taken by anglers while fishing in the specific areas above (WDFW 2000).

The objective of this Biological Opinion (Opinion) is to determine whether NMFS' issuance of an ESA section 10(a)(1)(B) permit to WDFW for the conduct of the specified recreational fisheries is likely to jeopardize the continued existence of ESA-listed Upper Columbia River steelhead and spring chinook, or result in destruction or adverse modification of the species' designated critical habitat, if applicable. This Opinion evaluates the effects of recreational fisheries that have been proposed or are expected to be proposed for the years 2000 through 2004. If any future analysis of fisheries indicates that impacts may be significantly greater than those anticipated in this Opinion, then NMFS will reinitiate consultation on those proposed action(s).

B. Conditions of Section 10 Permit

NMFS proposes to issue a section 10 permit with terms and conditions. NMFS' non-discretionary conditions would ensure that annual incidental takes of ESA-listed Upper Columbia River spring chinook and steelhead will not appreciably reduce the likelihood of survival and recovery of the species in the wild. Specifically, NMFS' conditions are designed to minimize ESA-listed fish mortalities incidental to the conduct of the recreational fisheries actions managed by WDFW. A list of the Special Conditions to be placed in the permit are as follows:

1. WDFW shall manage recreational fisheries within the Upper Columbia River ESUs to minimize impacts on ESA-listed salmonids:

    a. WDFW must manage recreational fisheries to limit the take of ESA-listed spring chinook and steelhead to the levels described in the permit application.

[1] Correction to original application (J. Anderson *et al.* (WDFW), pers. comm. to R. Bayley (NMFS), August 16, 2000).

b. WDFW must provide a timely notice to the NMFS, Hatchery and Inland Fisheries Branch Office in Portland, Oregon, of any proposed changes to WDFW's fishing regulations affecting listed spring chinook and steelhead in Columbia River Basin waters upstream of Priest Rapids Dam.

c. WDFW shall provide NMFS with a timely notice of any proposed fishery for non-listed anadromous salmon, including:

- Projected number of non-listed, hatchery-produced salmon that are available for harvest;
- Estimated incidental take of ESA-listed species if any;
- Proposed regulations including time, location, bag limits, and tackle restrictions; and
- Proposed monitoring and law enforcement plans.

After NMFS' review, the proposed fishery is subject to approval by the Regional Administrator.

d. WDFW shall take measures to reduce the deliberate illegal take of ESA-listed fish. Enforcement personnel and conservation officers shall report the incidental take of ESA-listed adult and juvenile salmon and steelhead in the fisheries. WDFW personnel shall conduct creel surveys or other forms of angler contact to monitor the incidence of illegal harvest activity.

e. WDFW shall take measures to prevent the inadvertent illegal take of ESA-listed fish by taking measures to educate anglers on subjects such as differentiating between ESA-listed from non-listed fish, how to identify and avoid redds, and methods for releasing non-target fish. Actions should also be taken to identify and protect, through warning signs or other means critical spawning areas of ESA-listed salmon.

f. The total annual take of ESA-listed species incidental to fisheries conducted under WDFW's proposed recreational fishery regulations shall be:

1. Up to 870 juvenile chinook salmon caught and released in the Methow River trout fisheries, of which 44 fish may die from catch-and-release mortality;
2. Up to 8 (range 0-8) listed spring chinook incidentally harvested in the Leavenworth Hatchery chinook fishery in Icicle Creek;
3. Up to 3,000 hatchery-origin juvenile steelhead and 9,500 rainbow trout or natural-origin juvenile steelhead (*O. mykiss*) in unknown proportion, caught and released in Methow River trout fisheries, of which no more than 5% (150 hatchery-origin juvenile steelhead and 0-475 natural-origin juvenile steelhead) may die; and

4. Up to 70 (range 0-70) hatchery- and natural-origin adult steelhead caught and released in the recreational fisheries, of which 7 would die.

2. WDFW shall conduct sufficient monitoring activities to allow the accurate and timely enumeration of observed and estimated mortalities of ESA-listed fish.

   a. WDFW shall monitor recreational fisheries at levels comparable to those in recent years for the incidental catch of ESA-listed spring chinook and steelhead. Sampling all recreational fisheries which may take ESA-listed species for catch composition, including the collection of biological information, must be increased where necessary to ensure a thorough post-season analysis of fishery impacts on ESA-listed species.

3. WDFW shall maintain law enforcement and public information programs to provide protection and ensure compliance with protective regulations for ESA-listed anadromous fish.

   a. WDFW shall continue to provide public education and information materials that emphasize the importance of protecting ESA-listed anadromous fish species.

   b. WDFW shall participate with co-managers and land management agencies in providing signs warning the public to avoid disturbing spawning salmon, avoid wading or boating activities that damage redds, and explaining the legal and biological consequences of harming ESA-listed fish.

   c. WDFW shall provide law enforcement patrols focused on times and areas where ESA-listed anadromous fish may be vulnerable to illegal harvest or harassment.

   d. WDFW shall restrict fishing activities and increase enforcement emphasis on regulations at any time or place that is identified during the monitoring of fisheries as a hazard to ESA-listed species.

4. WDFW must submit an annual report after each fishing season that provides a description of activities and a summary of ESA-listed fish takes for the year. This report shall include an analysis of the impacts on ESA-listed fish resulting from each fishery, including both natural and hatchery-origin impacts. Annual reports are due by April 15 following each year that the permit is effective. Annual reauthorization of the permit will depend on timely submittal of the report by WDFW and approval of the content of the report by NMFS' Hatcheries and Inland Fisheries Branch in Portland, Oregon.

   The report must include:

a. a detailed description of activities conducted under this permit including the estimated number of each species of ESA-listed salmon and steelhead taken, and estimate of the number of mortalities of ESA-listed salmon and steelhead, the manner of take, and the dates/locations of take;

b. a detailed description of the sampling methods used in the creel survey in the Methow River and the results from the survey;

c. a detailed description of the sampling methods used to evaluate any incidental harvest of natural- or hatchery-origin ESA-listed spring chinook in the Icicle Creek fishery and the results from the sampling;

d. measures taken to minimize disturbances to ESA-listed fish and the effectiveness of these measures, a description of the effects of recreational fishery management on the subject species, the disposition of ESA-listed fish in the event of mortality, and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities;

e. any problems that may have arisen during the conduct of fisheries management activities and a statement as to whether or not the fishery activities had any unforeseen effects;

f. a summary of law enforcement and public education efforts;

g. a summary of the measures taken to reduce deliberate illegal takes of ESA-listed fish;

h. a description of how all take estimates were derived;

i. a summary of the results of the required monitoring activities and creel surveys; and

j. steps that have been and will be taken to reduce the impact of recreational fisheries on ESA-listed species.

III. Species Included in this Consultation

Since all of the fisheries actions proposed by WDFW occur upstream of Priest Rapids Dam on the Columbia River, the only listed ESUs that will be affected are Upper Columbia River spring chinook and steelhead.

A. Status of the Species

Upper Columbia River Spring-run Chinook Salmon ESU

The UCR spring-run chinook salmon ESU (**Figure 1**) was listed as endangered on March 24, 1999 (64 FR 14308), and includes all natural-origin stream-type chinook salmon from river reaches above Rock Island Dam and downstream of Chief Joseph Dam, including the Wenatchee, Entiat, and Methow River basins. The spring-run components of the following hatchery stocks are also listed: Chiwawa, Methow, Twisp, Chewuch, and White rivers, and Nason Creek. Critical habitat was designated for UCR spring chinook salmon on December 28, 1993 (58 FR 68543). All chinook in the Okanogan River are apparently ocean-type and are considered part of the Upper Columbia River Summer-and Fall-run ESU.

Upper Columbia River Steelhead ESU

The UCR steelhead ESU (**Figure 2**) was listed as endangered on August 18, 1997 (62 FR 43937), and includes all natural-origin populations of steelhead in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S./Canada Border. The Wells Hatchery stock is included among the listed populations. Critical habitat was designated for UCR steelhead on February 16, 2000 (65 FR 7764).

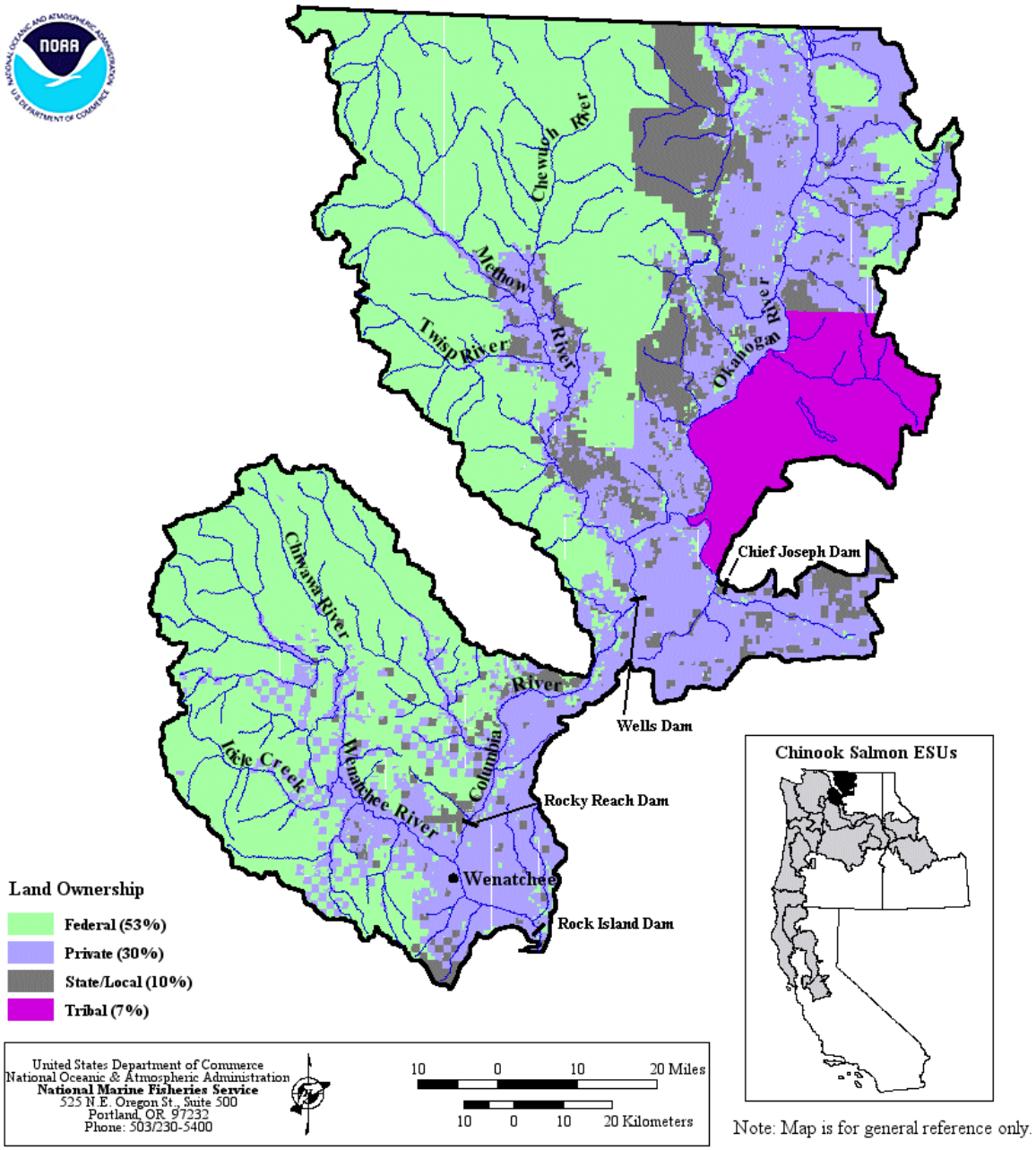

Figure 2. Upper Columbia River spring-run chinook Evolutionarily Significant Unit.

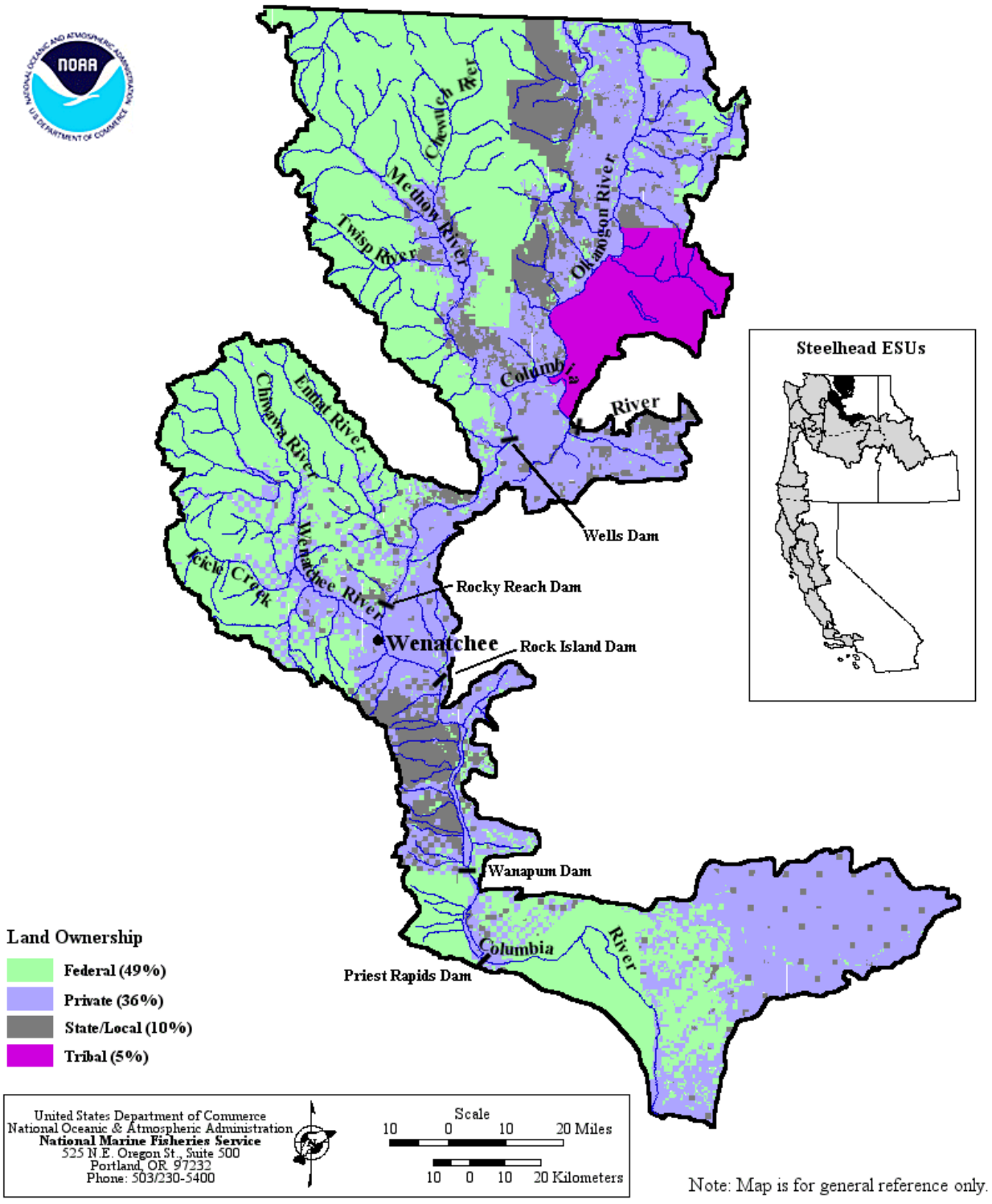

Figure 3. Upper Columbia River steelhead Evolutionarily Significant Unit.

B. General Life Histories

1. Chinook Salmon

Chinook are the largest of the Pacific salmon. Historically, the species was distributed from the Ventura River in California to Point Hope, Alaska, in North America, and in northeastern Asia from Hokkaido, Japan, to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit arguably the most diverse and complex life history strategies. Healey (1986) described 16 age categories for chinook salmon, 7 total ages with 3 possible freshwater ages. This level of complexity is roughly comparable to that seen in sockeye salmon (*O. nerka*), although the latter species has a more extended freshwater residence period and uses different freshwater habitats (Miller and Brannon 1982; Burgner 1991). Two generalized freshwater life-history types were initially described by Gilbert (1912): "stream-type" chinook salmon, which reside in freshwater for a year or more following emergence, and "ocean-type" chinook salmon, which migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for "ocean-type" and "stream-type" to describe two distinct races of chinook salmon. Healey's approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons among chinook salmon populations.

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater; migration to the ocean; and the subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. The juvenile rearing period in freshwater can be minimal or extended. Additionally, some male chinook salmon mature in freshwater, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is likely related to genetic and environmental determinants and their interactions to varying degrees. Although salmon exhibit a high degree of variability in life-history traits, there is considerable debate as to what degree this variability is shaped by local adaptation or is the result of general plasticity in the salmonid genome (Ricker 1972; Healey 1991; Taylor 1991). More detailed descriptions of the key features of chinook salmon life history can be found in Myers *et al.* (1998) and Healey (1991).

2. Steelhead

Steelhead can be divided into two basic run-types based on the state of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner *et al.* 1992). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variation in migration timing exists among populations. Some river basins have both summer and winter steelhead, whereas others only have one run-type.

In the Pacific Northwest, summer steelhead enter fresh water between May and October (Busby *et al.* 1996; Nickelson *et al.* 1992). During summer and fall, prior to spawning, they hold in cool, deep pools (Nickelson *et al.* 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration in early spring to natal streams, and then spawn (Meehan and Bjornn 1991; Nickelson *et al.* 1992). Winter steelhead enter fresh water between November and April in the Pacific Northwest (Busby *et al.* 1996; Nickelson *et al.* 1992), migrate to spawning areas, and then spawn in late winter or spring. Some adults, however, do not enter coastal streams until spring, just before spawning (Meehan and Bjornn 1991). Difficult field conditions (snowmelt and high stream flows) and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning.

Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying and most that do so are females (Nickelson *et al.* 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Multiple spawnings for steelhead range from 3% to 20% of runs in Oregon coastal streams.

Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986; Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973) are required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn further upstream than winter steelhead (Withler 1966; Behnke 1992).

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (61 FR 41542; August 9, 1996) before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al.* 1992).

Juveniles rear in fresh water from one to four years, then migrate to the ocean as smolts. Winter steelhead populations generally smolt after two years in fresh water (Busby *et al.* 1996). Steelhead typically reside in marine waters for two or three years prior to returning to their natal stream to spawn at four or five years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby *et al.* 1996). Age structure appears to be similar to other west coast steelhead, dominated by four-year-old spawners (Busby *et al.* 1996).

Based on purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer rather than migrating along the coastal belt as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986). Oregon steelhead tend to be north-migrating (Nicholas and Hankin 1988; Pearcy *et al.* 1990; Pearcy 1992).

C. Population Dynamics and Distribution

The following sections provide specific information on the distribution and population structure (size, variability, and trends of the stocks or populations) of each listed ESU. Most of this information comes from observations made in terminal, freshwater areas, which may be distinct from the action area. This focus is appropriate because the species status and distribution can only be measured at this level of detail as adults return to spawn.

1. Upper Columbia River spring chinook salmon

The UCR spring chinook ESU inhabits tributaries upstream from the Yakima River to Chief Joseph Dam. Upper Columbia River spring chinook have a stream-type life history. Adults return to the Wenatchee River during late March through early May, and to the Entiat and Methow rivers during late March through June. Most adults return after spending two years in the ocean, although 20% to 40% return after three years at sea. UCR spring chinook experience very little ocean harvest. Peak spawning for these three populations (Methow, Entiat, and Wenatchee) occurs from August to September. Smolts typically spend one year in freshwater before migrating downstream. There are slight genetic differences between this ESU and others containing stream-type fish, but more importantly, the ESU boundary was defined using ecological differences in spawning and rearing habitat (Myers *et al.* 1998). The Grand Coulee Fish Maintenance Project (1939 through 1943) may have had a major influence on this ESU because fish from multiple populations were mixed into one relatively homogenous group and redistributed into streams throughout the Upper Columbia Region.

Three independent populations of spring chinook salmon are identified for the ESU including those that spawn in the Wenatchee, Entiat, and Methow basins (Ford *et al.* 1999). The number of natural-origin fish returning to each subbasin is shown in Table 2. The NMFS recently proposed Interim Recovery Abundance Levels and Cautionary Levels (i.e, interim levels still under review and are subject to change). Ford *et al.* (1999) characterize Cautionary Levels as abundance levels that the population fell below only about 10% of the time during a historical period when it was considered to be relatively healthy. Escapement has been substantially below the Cautionary Levels in recent years, especially since 1995, indicating increasing risk to and uncertainty about the population's future status. On the other hand, preliminary returns for 1999, the primary return year for the 1995 brood, indicate that although they were low, returns were still substantially higher than the estimated cohort replacement level. Very strong 1999 jack returns suggest that survival rates for the 1996 brood will be high, as well. A total of 4,500 natural-origin UCR spring chinook are expected to return to the mouth of the Columbia River during

2000 with a corresponding expected return near each subbasin's Cautionary Level (accounting for expected harvest, inter-dam loss, and prespawning mortality; Table 2).

Table 2. Estimates of the number of natural-origin spring chinook returning to subbasins for each independent population of Upper Columbia River spring chinook salmon and preliminary Interim Recovery Abundance and Cautionary levels.

Year	Subbasin		
	Wenatchee River	**Entiat River**	**Methow River**
1979	1,154	241	554
1980	1,752	337	443
1981	1,740	302	408
1982	1,984	343	453
1983	3,610	296	747
1984	2,550	205	890
1985	4,939	297	1,035
1986	2,908	256	778
1987	2,003	120	1,497
1988	1,832	156	1,455
1989	1,503	54	1,217
1990	1,043	223	1,194
1991	604	62	586
1992	1,206	88	1,719
1993	1,127	265	1,496
1994	308	74	331
1995	50	6	33
1996	201	28	126
1997	422	69	247
1998	218	52	125
1999[1]	119	64	73
2000	*1,295*	*180*	*811*
1996-2000 average	451	79	276
Recovery Abundance	**3,750**	**500**	**2,000**
Cautionary Abundance	**1,200**	**150**	**750**

[1] Estimates for 1999 are preliminary; estimates for 2000 (italics) are based on the preseason forecast (actual return data not available 10/17/00).

Six hatchery populations were considered essential for recovery and listed. Artificial production programs for fishery enhancement and hydropower mitigation in the UCR have recently generated concern because a non-indigenous stock was used. However, programs have been initiated to develop locally-adapted brood stocks to supplement natural populations and facilities where straying and interactions with natural stock are known problems are phasing out the use of Carson stock. Captive broodstock conservation programs are currently under way in Nason Creek and White River (the Wenatchee basin) and in the Twisp River (Methow basin), to prevent the extinction of those spawning populations. All spring chinook salmon passing Wells Dam in 1996 and 1998 were trapped and brought into the hatchery to begin a composite broodstock supplementation program for the Methow Basin.

Ford *et al.* (1999) proposed recovery abundance levels of for the three spawning populations in the UCR spring chinook ESU (i.e., 3,750 spawners for the Wenatchee; 2,000 for the Methow; and 500 for the Entiat river). For the ESU as a whole, the Cumulative Risk Initiative (CRI) estimated an average population growth rate (lambda) of 0.876 (McClure *et al.* 2000). The CRI estimated average growth rates and the risk of extinction for each of the three spawning populations, incorporating the proportion of spawners that were hatchery fish and assuming that hatchery fish do not reproduce. Lambda ranged from 0.801 for the Wenatchee to 0.932 for the Methow river population (Table 3). The risk of absolute extinction within 100 years ranged from 71% for the Methow to 100% for the Entiat and Wenatchee river populations–the model indicates a 100% likelihood of extinction for the Wenatchee River population even over a 48-year time period. All three populations have a relatively low short-term (24-year) risk of extinction, ranging from 0 - 7%.

As part of the Quantitative Analytical Review (QAR) for listed species (spring chinook salmon and steelhead) in the upper Columbia basin, NMFS chaired an interagency group that applied the principles contained in the draft Viable Salmonid Populations paper (McElhany *et al.* 2000) to these ESUs. The QAR process used an alternative model called the Cohort Replacement Rate (CRR) Model (Botsford and Britenacher 1998) to estimate extinction risks and recovery survival requirements for the Wenatchee, Methow, and Entiat spawning populations. The CRR model is specifically adapted to the life history structure of salmon and a variation accommodates ceilings on smolt production based on estimates habitat capacity (Cooney 2000). The CRR model used the same spawner recruit data series as the CRI model and estimated similar extinction risks when applied to the same base period (1980 through 1994 brood years). The CRR estimated extinction risks within 100 years of 98 to 99% for the Wenatchee and Entiat spring chinook salmon spawning populations, and over 50% for the Methow, assuming that the conditions that affected the 1980 through 1994 brood years continue into the future. Both modeling systems indicate that substantial improvement in average survival (over the levels experienced by the 1980 through 1994 broods) will be required to reduce long-term extinction risk to acceptable levels (e.g., less than 5%).

Table 3. Results of the Dennis Extinction Analysis for individual stocks (McClure *et al.* 2000). The threshold for the risk of absolute extinction is one fish returning in one generation; the risk of a 90% decline in abundance is also shown. This analysis incorporated the proportion of natural spawners that were of hatchery-origin but assumed that hatchery fish did not reproduce.

ESU/Stream	Estimated Pop. Size	Lambda	Risk of Absolute Extinction			Risk of a 90% Decline in		
			24-Year	48-Year	100-Year	24-Year	48-Year	100-Year
Upper Columbia River spring-run chinook ESU								
Methow River	433	0.932	0.07	0.33	0.71	0.40	0.62	0.82
Entiat River	173	0.890	0.00	0.68	1.00	0.71	1.00	1.00
Wenatchee River	805	0.801	0.03	1.00	1.00	1.00	1.00	1.00
Upper Columbia River steelhead ESU	7,708	0.898	0.00	0.00	0.84	0.61	0.98	1.00

2. Upper Columbia River steelhead

Upper Columbia River steelhead inhabit the Columbia River reach and its tributaries upstream of the Yakima River. This region includes several rivers that drain the east slopes of the Cascades Mountains and several that originate in Canada (only U.S. populations are included in the ESU). Dry habitat conditions in this area are less conducive to steelhead survival than in many other parts of the Columbia basin (Mullan *et al.* 1992a). Although the life history of this ESU is similar to that of other inland steelhead, smolt ages are some of the oldest on the west coast (up to 7 years old), probably due to the ubiquitous cold water temperatures (Mullan *et al.* 1992b). Adults spawn later than in most downstream populations, remaining in freshwater up to a year before spawning.

Although runs during the period 1933 through 1959 may have already been affected by fisheries in the lower river, dam counts suggest a pre-fishery run size of more than 5,000 adults above Rock Island Dam. The return of Upper Columbia River natural-origin steelhead to Priest Rapids Dam declined from a 5-year average of 2,700 beginning in 1986 to a 5-year average of 900 beginning in 1994 (FPC 1998; Table 4). The escapement goal for natural-origin fish is 4,500. Most current natural production occurs in the Wenatchee and Methow River system, with a smaller run returning to the Entiat River. Very limited spawning also occurs in the Okanagan River basin. A majority of the fish spawning in natural production areas are of hatchery origin. Indications are that natural populations in the Wenatchee, Methow, and Entiat rivers are not self-sustaining.

This entire ESU has been subjected to heavy hatchery influence; stocks became thoroughly mixed as a result of the Grand Coulee Maintenance Project, which began in the 1940s (Fish and Hanavan 1948; Mullan *et al.* 1992a). Recently, as part of the development of the Mid-Columbia Habitat Conservation Plan (HCP), it was determined that steelhead habitat within the range of the Upper Columbia ESU was overseeded, primarily due to the presence of Wells Hatchery fish in excess of those collected for broodstock. This would partially explain observations of low natural cohort replacement rates prior to 1995 (0.3 for populations in the Wenatchee River and no greater than 0.25 for populations in the Entiat River (Bugert 1997)). The problem of

determining appropriate levels of hatchery output to prevent negative effects on natural production is a subject of analysis and review in the mid-Columbia Quantitative Analytical Report (Cooney 2000). In the meantime, given these uncertainties, efforts are underway to diversify broodstocks used for supplementation and to minimize the differences between hatchery and natural-origin fish (as well as other concerns associated with supplementation). The best use for the Wells Hatchery program in the recovery process is yet to be defined, and should be integrated with harvest activities and recovery measures to optimize the prospects for recovery of the species.

Ford *et al.* (1999) proposed recovery abundance levels for each of the three spawning populations identified for the UCR steelhead ESU (i.e., 2,500 spawners for the Wenatchee and Methow rivers and 500 for the Entiat River). However, the population level data were not adequate for assessing average population growth rates or the risk of extinction using the Dennis model. The CRI estimated an average growth rate (lambda) for the ESU as a whole of 0.860 (McClure *et al.* 2000). Lambda was only slightly higher when the proportion of spawners that are hatchery fish was taken into account (0.898, Table 3). The estimated risk of absolute extinction within 100 years for the ESU as a whole was 84%.

The QAR process applied the CRR model to the aggregate population of UCR steelhead returning to the Wenatchee and Entiat rivers and to the spawning population in the Methow (Cooney 2000). Both components are currently dominated by hatchery returns. In order to estimate extinction risk for the naturally-produced run, the model inputs included an assumption that all hatchery inputs ceased after 1999. The QAR recommended a range assumptions about the relative effectiveness of hatchery fish spawning in the wild compared to spawners of natural parentage (0.25:1 to 1:1). The higher the assumption of hatchery productivity, the higher the extinction risk of the wild segment of the population.

Table 4. Adult summer steelhead counts at Priest Rapids, Rock Island, Rocky Reach, and Wells dams (FPC 2000). (*Preliminary counts as of 10/16/2000).

Year	Priest Rapids		Rock Island	Rocky Reach	Wells
	Count	Wild Origin	Count	Count	Count
1977	9,812		9,925	7,416	5,382
1978	4,545		3,352	2,453	1,621
1979	8,409		7,420	4,896	3,695
1980	8,524		7,016	4,295	3,443
1981	9,004		7,565	5,524	4,096
1982	11,159		10,150	6,241	8,418
1983	31,809		29,666	19,698	19,525
1984	26,076		24,803	17,228	16,627
1985	34,701		31,995	22,690	19,757
1986	22,382	2,342	22,867	15,193	13,234
1987	14,265	4,058	12,706	7,172	5,195
1988	10,208	2,670	9,358	5,678	4,415
1989	10,667	2,685	9,351	6,119	4,608
1990	7,830	1,585	6,936	5,014	3,819
1991	14,027	2,799	11,018	7,741	7,715
1992	14,208	1,618	12,398	7,457	7,120
1993	5,455	890	4,591	2,815	2,400
1994	6,707	855	5,618	2,823	2,138
1995	4,373	993	4,070	1,719	946
1996	8,376	843	7,305	5,774	4,127
1997	8,948	785	7,726	7,726	4,107
1998	5,837	919	4,810	4,265	2,482
1999	8,456	1,428	6,361	4,815	3,557
2000*	10,069	not avail.	9,705	7,396	5,225
1995-1999 average	7,198	994	6,054	4,860	3,044

D. Critical Habitat

Critical habitat was designated for the Upper Columbia River ESUs on February 16, 2000 (65 FR 7764). The designation of critical habitat provides notice to Federal agencies and the public that these areas and features are vital to the conservation of listed salmon and steelhead.

The essential features of the Columbia River adult migration corridor for listed salmon and steelhead are described in Appendix A.

IV. Environmental Baseline

Environmental baselines for biological opinions include the past and present impacts of all state, Federal or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02). The environmental baseline for this Opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. In addition to artificial propagation actions, the activities having the greatest impact on the environmental baseline generally fall into three categories: hydropower system impacts on juvenile outmigration and adult return migration; habitat degradation effects on water quality and availability of adequate incubation and rearing locations; and harvest impacts on adults. Fish are also affected by fluctuations in natural conditions. In addition to hatchery actions, the following discussion reviews recent developments in each of these sectors, and outlines their anticipated impacts on natural conditions and the future performance of the listed ESUs.

The environmental baseline analysis is not fully developed here with respect to actions taken in other sectors. This is due to the short time frame imposed by the upcoming release of hatchery fish and the number of listed salmon and steelhead. However, in developing conclusions with respect to the proposed action, NMFS has paid particular attention to the discussion of the species' status and population trends which reflect the additive effects of past and on-going human and natural factors leading to the current status of the species.

A. Hydropower Impacts

Columbia River Basin salmon and steelhead, especially those above Bonneville Dam, have been dramatically affected by the development and operation of the Federal Columbia River Power System (FCRPS). Storage dams have altered the natural hydrograph of the Snake and Columbia rivers, decreasing spring and summer flows and increasing fall and winter flows. Power operations cause fluctuation in flow levels and river elevations, affecting fish movement through reservoirs and riparian ecology and stranding fish in shallow areas. The dams in the migration corridor of the Snake and Columbia rivers block migration of smolts and adults. Smolts experience a high level of mortality passing the dams. The dams also have converted the once-swift river into a series of slack-water lakes, slowing the smolts' journey to the ocean and creating habitat for predators.

There have been numerous changes in the operation and configuration of the FCRPS as a result of ESA consultations between the action agencies (Bureau of Reclamation, BPA and USACE) and the Services (NMFS and USFWS). These have resulted in survival improvements for listed

fish migrating through the Snake and Columbia rivers. Increased spill at all of the FCRPS dams allows smolts to avoid both turbine intakes and bypass systems. Increased flow in both the Snake and Columbia River mainstems provides better inriver conditions for smolts. The transportation of smolts from the Snake River has also improved by the addition of new barges and modification of existing barges.

In addition to the flow, spill and transportation improvements, the USACE has implemented numerous other improvements to project operations and maintenance at all Columbia and Snake River dams. These improvements, such as operating turbines at peak efficiency, new extended length screens at McNary, Little Goose, and Lower Granite dams, and extended operation of bypass screens, are enumerated in greater detail in the 1995 biological opinion on operation of the FCRPS (NMFS 1995).

Since the 1995-1998 FCRPS opinion, a concerted effort has continued in the region to evaluate options for modification and future operation of the hydropower system. The 1998 report of the Plan for Analyzing and Testing Hypotheses (PATH) process describes Snake River spring/summer chinook salmon recovery prospects under several modeled scenarios (Marmorek *et al.* 1998).

Results of the PATH analysis indicate that, under some sets of assumptions, current harvest practices coupled with any of the future hydro actions will lead to meeting biological requirements. Under other sets of assumptions, biological requirements are not met. Actions that meet biological requirements under a larger proportion of the hypothesis sets examined by PATH are more robust, given the uncertainties that led to consideration of alternative assumptions.

Results of these analyses suggest that the first sensitivity harvest rate schedule made little difference in the unweighted mean probabilities of exceeding survival thresholds or achieving recovery levels (an increase of approximately 1% or less). The second sensitivity harvest rate schedule (constant 3% harvest rate) had a somewhat greater effect (an increase of approximately 1-3%) for hydro actions that produced smaller numbers of forecasted spawners (those representing current hydrosystem configuration). However, at higher levels of forecast abundance (such as dam breaching alternatives), larger reductions in harvest rates in some cases lead to small decreases in the probability of meeting jeopardy standards (less than 3% reduction) due to over-escapement, which leads to lower levels of recruitment. The results of this analysis cannot be used to explicitly adjust the unweighted mean probabilities, because the same sets of alternative assumptions were not included in each analysis. However, the sensitivity analyses provide an approximate understanding of the level of change that might occur as a result of changing harvest rates.

In any case, some improvements in the hydropower system (such as passage improvements at dams) benefit only those listed salmonids that pass those dams; other improvements (such as increased flows) benefit all salmonids in the Columbia Basin. It is difficult to quantify the

survival benefits from these many actions for each listed ESU. For Snake River spring/summer chinook smolts migrating inriver, the estimated survival through the hydropower system is now 40-60%, compared to an estimated survival rate during the 70's of 20-40%. It is likely that Snake River steelhead have received a similar benefit as their life history and run timing is similar to that of spring/summer chinook. It is more difficult to obtain direct data and compare survival improvements for fish transported from the Snake River, but there are likely to be improvements for transported fish as well. It is reasonable to expect that the improvements in operation and configuration of the FCRPS will benefit all listed Columbia Basin salmonids and that the benefits will be greater the farther upriver the ESU is. Nonetheless, because the hydropower system is widely accepted to be the single greatest source of salmon mortalities in the basin, further improvements must continue to be made.

B. Habitat Impacts

Land management activities affect aquatic health and salmon and steelhead survival in a number of ways. For example, timber harvest, road-building, grazing, cultivation and other activities can increase sediment, destabilize banks, reduce organic litter and woody debris, increase water temperatures, simplify stream channels, and increase peak flows. Habitat quality for Columbia River Basin salmon and steelhead varies widely from ESU to ESU, and the habitat of each is affected by a different set of land management activities. The vast majority of land management activities on Federal land have undergone consultation and the U.S. Forest Service and Bureau of Land Management have adopted forest plans that should improve watershed health. (For example, the Aquatic Conservation Strategy of the Northwest Forest Plan, on which NMFS has consulted, includes strong measures to protect aquatic habitats.) NMFS expects habitat quality to improve over time on Federal land to the point that all Federal land provides properly functioning watershed conditions for salmon and steelhead. This, in turn, should result in improved spawning and rearing success for the listed ESUs.

ESA consultations do not cover non-Federal lands as completely as Federal lands. NMFS has consulted on some activities on non-Federal land, but the acreage covered is quite small and the impact will therefore be much less on non-Federal than on Federal lands. The Cumulative Effects section of this opinion considers likely future impacts from land management activities not subject to section 7 consultations.

NMFS has not analyzed fully how much of the habitat for each ESU is in Federal ownership, what role that habitat might play in establishing population strongholds, and whether there is sufficient physical connectivity between high quality habitats to ensure persistence for each ESU. NMFS is also not able at this time to quantify improvements in productivity that should result from improvements in habitat conditions. It is reasonable to expect, however, that improvements in land management on Federal land throughout the Basin will result in improved overall survivals for the listed ESUs considered in this Opinion. It must be noted that the vast area over which habitat needs to be improved — coupled with the long time periods such a process generally requires — will tend to limit progress both in terms of scope and pace. It took many

years of poorly-informed land management to arrive at the current degraded conditions, and it will take many more to see a similar improvement.

C. Natural Conditions

Recent natural conditions have not been good for listed Columbia River Basin ESUs. Most have suffered from poor ocean survivals over the past two decades, exacerbated by El Niño events. However, in more recent years ocean conditions have improved and the survival of listed fish has increased. A recent increase in bird populations in the Lower Columbia River has resulted in high levels of predation on smolts. The world's largest colony of Caspian terns and the two largest colonies of double-crested cormorants on the west coast of North America have recently become established in the Columbia estuary. The tern colony alone is estimated to take between 6 and 25 million smolts annually. Total predation impacts are estimated to be in the range of 10 to 30 percent of all salmonid smolts that reach the estuary. NMFS biologists estimate that one to three million smolts of listed or proposed species are being taken from the estuary annually by avian predators. This smolt loss may represent more than 30,000 adults of listed species that are lost to future spawning escapements. Two smaller tern colonies, several large gull colonies and cormorants living on islands in the upstream hydropower reservoirs consume additional millions of smolts. It is also reasonable to expect that current efforts to relocate the bird populations will eventually reduce the bird predation. These conditions, however, are currently creating a survival bottleneck for many listed populations.

D. Fisheries

Fish harvest in the Columbia River basin affects the listed species by incidentally taking them in fisheries that target non-listed species. Most take is in the form of catch and retention, mortalities resulting from hooking and release, and mortalities resulting from encounters with fishing gear as a consequence of fishery activities. Taking occurs in both Treaty and non-Treaty harvest. A recent biological opinion on inriver harvest concluded that, due to the constraints set on harvest levels as described in the opinion's Reasonable and Prudent Alternative, the activities associated with the Treaty and non-treaty fisheries were not likely to jeopardize the continued existence of any of the listed species (NMFS 2000a).

To illustrate, the treaty Indian fisheries considered in the 2000 winter/spring/summer mainstem fisheries biological opinion were constrained to harvest rates in all fisheries combined of no greater than 9% for returns of naturally-produced Upper Columbia River spring chinook. The harvest rate limit for the artificially-produced component of the Upper Columbia River spring chinook ESU is no more than 6.0 percent. The harvest rate limits for Upper Columbia River hatchery- and natural- origin steelhead are 5.6% and 3.6%, respectively. The development of fishery regimes for the Columbia River mainstem includes evaluation of escapement needs and impacts to Upper Columbia River spring chinook and steelhead.

E. Ocean fisheries

While impacts from ocean fisheries on sockeye and chinook salmon listed or proposed for listing are not within the action area of the proposed action, those impacts are summarized here to provide a more complete accounting of harvest impacts on these species.

Impacts from ocean fisheries on listed spring/summer chinook and sockeye salmon have been considered in recent biological opinions. The ocean distribution of this the Upper Columbia River spring chinook salmon ESU is generally to the north and offshore. Upper Columbia River Spring chinook are similar to Snake River spring/summer chinook in that they are subject to very little ocean harvest. NMFS (1998) also reviewed the potential impacts to steelhead for ocean salmon fisheries. Since steelhead are only rarely caught in these fisheries, it is unlikely that the Upper Columbia River steelhead ESU is significantly impacted.

F. Scientific Research in the Action Area

There are several scientific research permits that have activities occurring in the Action Area for this Opinion. Below is a brief summary of the permits issued by NMFS:

Permit 1114 - authorizes the WDFW annual direct takes of adult and juvenile, endangered, naturally-produced and artificially- propagated, UCR steelhead associated with a smolt monitoring program at Rock Island Dam. Data gathered under this permit will be used to make in-season adjustments to water releases from upstream reservoirs that optimize downstream migration conditions.

Permit 1115 - authorizes the Chelan County PUD annual takes of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with fish passage studies at Rocky Reach Dam, Rock Island Dam, and the Lake Chelan hydroelectric project on the Columbia River. Results will be used to improve the operation of fish passage facilities at the dams, determine the types and numbers of adult salmonids that may be present in the Lake Chelan bypass reach after spill at the Lake Chelan hydroelectric project is curtailed, and identify a mitigation strategy to protect anadromous and resident fish that may become stranded in the Lake Chelan bypass reach after spill is curtailed.

Permit 1119 - authorizes the U.S. Fish and Wildlife Service (USFWS) annual takes of adult and juvenile, endangered, naturally- produced and artificially-propagated, UCR steelhead associated with scientific research studies. The objectives of the research are to gather data on emerging juvenile salmon and steelhead, to conduct snorkel surveys in various watersheds as part of inventory and artificial structure monitoring projects, and to evaluate the feasibility of restoring endangered UCR steelhead and UCR spring chinook salmon above barriers in Icicle Creek, a tributary to the Wenatchee River. The data obtained from the research will be used to determine the survival and contribution of chinook salmon and steelhead released from USFWS mitigation hatchery programs in central WA and to provide technical assistance to agencies, tribes, and

interest groups using and managing aquatic resources in the Mid to Upper-Columbia River Basin. If successfully introduced above the barriers in Icicle Creek, endangered UCR steelhead and UCR spring chinook salmon will benefit by having access to a well managed wilderness watershed having suitable fish rearing habitat.

Permit 1141 - authorizes the Grant County PUD annual direct takes of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with a fish salvage operation and three scientific research studies at Wanapum and Priest Rapids dams located on the Columbia River. The results of the studies will benefit the ESA-listed species by providing information that will assist facility operators to minimize adverse impacts to the fish as a consequence of hydropower dam operations, by providing information on the status of ESA-listed and non-listed fish inhabiting the project area, and by providing dam operators with valuable information on the survival of ESA-listed fish in the UCR.

Permit 1203 - authorizes the WDFW annual takes of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with five research studies in UCR tributaries and the mainstem river. In Study 1, WDFW will assess migrating juvenile salmonid populations. In Study 2, WDFW will trap returning adults at fish ladders, record biological information, and release them upstream. In Study 3, WDFW will survey spawning grounds to identify redds and collect biological data from carcasses. In Study 4, WDFW will assess the capacity of salmonid habitat. In Study 5, WDFW will conduct presence/absence studies by using electroshockers to determine the distribution of salmonids in various watersheds. Data from these five studies will provide managers valuable information that will be used to assess the survival of migrating juvenile salmonids, the abundance of adults on spawning grounds, the annual success of spawners, and the relative abundance of salmonids in the available habitat. Indirect mortalities of adult and juvenile ESA-listed fish are also authorized.

These research activities should benefit the listed species in the Upper Columbia River Basin by collecting more data on the impacts of hydropower dams, habitat modifications, and hatchery operations for the environmental baseline.

G. Expected Future Performance

Most ESUs in the Columbia Basin will experience improved survivals as a result of more favorable ocean conditions, improvements in FCRPS operations and configuration, habitat improvements on Federal lands, improvements in hatchery practices, and improvements in harvest measures. Notwithstanding these improvements, however, is the fact that environmental conditions are still generally quite poor with respect to salmonid survival in a number of their life phases. For many stocks, survivals must improve by an order of magnitude in order for the ESUs to survive and recover over the long-term. Smolt-to-adult return rates in 1998 for Snake River spring/summer chinook, for example, were less than one-half of one percent–about one-tenth the

rate needed for sustainability. However, during the last few years, the abundance of Upper Columbia River stocks has stabilized somewhat and the last run year has increased substantially. Adult returns in 2000 have increased compared to the average return the last few years (Tables 2 and 4) and are likely to continue to increase in the next few years based on abundance indices. The long-term survival of many ESUs from the Upper Columbia River Basin will depend upon improvements in ocean and habitat conditions and conditions in the mainstem corridor. NMFS does not have information to suggest that harvest is a major factor limiting recovery of Columbia River Basin stocks, though harvest reductions have been and will continue to be an important contributor to survival through the current bottleneck.

H. Hatchery Actions

The action area for this Opinion is that portion of the range of the listed salmon and steelhead that is directly and indirectly affected by hatchery operations. This includes the spawning/nursery areas, the Columbia River migration corridors, the Columbia River estuary, and ocean habitat.

The current hatchery system in the Columbia River Basin is made up of over 70 hatchery programs and associated satellite facilities, some of which were initiated more than 110 years ago, before the salmon and steelhead were listed pursuant to the ESA. Artificial production can adversely affect salmonids in a number of ways. Taking naturally produced fish for broodstock can deplete the naturally spawning populations; interbreeding between hatchery fish and naturally spawned fish can reduce the genetic fitness of the natural fish; hatchery fish can transmit diseases to natural populations; and hatchery fish compete with naturally spawned fish for space and food. Recently, the NMFS in cooperation with fishery co-managers has initiated steps to substantially revise hatchery management practices. For example, many non-indigenous stocks are no longer used for broodstock. Rather, broodstocks are largely being taken from locally adapted stocks. Also, artificial production levels are generally decreasing throughout the region, as a result of hatchery program modification and funding exigencies. This has the tendency to lower competition and decrease disease transmission rates.

It is expected that, with modifications based on increasing knowledge of hatchery operation interactions with natural populations, artificial propagation can have a substantially beneficial affect on listed populations. Captive broodstock programs are an extreme action that has been taken in some cases when the numbers of natural-origin fish reach levels where near-term extinction risk is very high. Less intrusive supplementation actions are taken in some cases to help accelerate rebuilding of natural-origin fish and thereby minimize genetic and demographic risks associated with low abundance. In some cases, when the habitat has been reduced or degraded to the extent that natural-origin fish can not survive without support, hatchery programs are used to preserve the critical genetic heritage until such time that necessary decisions can be made about future efforts for recovery. Although uncertainties remain about the effectiveness of supplementation programs, those uncertainties have to be weighed against the risk of not taking any remedial action. NMFS' general approach to the uncertainties associated with the use of

hatcheries for conservation purposes is to experiment with a variety of more or less aggressive strategies in different areas that will help inform future decisions about their use.

Hatchery operations and their effects on the survival and recovery of listed salmon and steelhead in the Upper Columbia River have been addressed in several opinions (NMFS 1995; NMFS 1999). In general, the role of artificial propagation in assisting in the recovery of these ESUs has been acknowledged; captive broodstock programs have been identified for several populations of spring chinook in the upper Columbia River, and their design and implementation is underway. The risks of artificial propagation are also being addressed, with development of local stocks to replace composite stocks as a priority for Upper Columbia River steelhead. Artificial propagation efforts in the UCR currently emphasize recovery purposes, and their contribution to fishery opportunity remains sensitive to the more critical recovery needs.

It is difficult to quantify the benefits of improvements in artificial production throughout the Columbia River Basin, but it is reasonable to expect that the listed ESUs will benefit over time from these improvements and that carefully designed intervention programs will improve the future prospects for survival and recovery.

I. Salmon Recovery Actions

A significant component of the environmental baseline of anadromous salmonids in the Columbia River Basin is the complex of actions being taken to achieve recovery of listed species. At this time, most naturally-produced anadromous salmonid ESUs in the Columbia River Basin are listed under the ESA. In the Upper Columbia River, all steelhead of hatchery and natural origin are listed; there are also listed components of hatchery-produced spring chinook salmon. Captive broodstocks of certain spring chinook salmon populations have also been developed. All waters which are accessible and utilized by anadromous fish have been designated as critical habitat and are now subject to protection under the ESA. Habitat management, water flow and management, and operation of the FCRPS are all considered in separate biological opinions and permitting actions. The elements of salmon recovery are discussed in the draft basin-wide Salmon Recovery Strategy (NMFS 2000b) and numerous other documents. The recreational fishing activity discussed in this opinion is coordinated with many other salmon recovery actions, and is a small part of the regionwide effort to restore listed species.

V. Effects of The Action

A. Factors to be considered

Recreational angling takes place in only a few of the Upper Columbia River waters occupied by listed salmon and steelhead. The distribution, timing and duration of fishing is carefully regulated to provide protection for listed species while still providing some recreational fishing opportunities.

Recreational angling can affect listed species directly through intentional illegal harvest, unintentional illegal harvest, hooking mortality of fish caught-and-released back into the stream and direct physical disturbance of fish. Angler access can affect habitat by trampling or removing riparian vegetation. Angling methods, including wading in streams and boat operation, can affect fish behavior and habitat.

The activity under the proposed regulations which has the greatest potential to impact listed species is catch-and-release trout fishing. Juvenile steelhead are similar in size, behavior and appearance to resident trout sought by anglers, and susceptible to harvest by the same angling techniques. Juvenile spring chinook are also large enough to be captured by trout anglers. Angling pressure is generally light and fishing tackle and bag limits are restricted. It is unlikely that adult spring chinook will be mistakenly harvested as a trout due to the large size difference between trout and salmon. In any case, however, all fish caught will be released back into the water unharmed in the catch-and-release trout fishery.

1. Impacts to fish habitat resulting from fishing

Angler access can affect habitat by trampling or removing riparian vegetation. Angling methods, including wading in streams and boat operation, can affect fish behavior and habitat. However, in terms of habitat disturbance, fishing activities are generally additive, yet small relative to other larger disturbances. The amount of travel on highways for the purpose of fishing is only a tiny fraction of their total other uses and the impact of angler access to the stream is undetectable within the larger impacts of road fill encroachment on stream channels, runoff from highway surfaces and increases in sediment due to highway construction and maintenance.

Boat operation can cause local displacement of juvenile salmon and can cause direct mortality to eggs and alevins when power boats are operated in shallow water. Eggs and developing alevins may be killed by substrate movement, displaced or buried in fine sediment caused by the turbulence of passing power boats (Horton 1994). The impacts reported by Horton were in depths less than 44 cm for propellor driven boats and less than 36 cm for jet-driven boats. Impacts were greatest immediately under the center line of the passing boat and were primarily related to displacement and movement of the stream bottom substrate by the water jet or prop-wash of the passing boat. Impacts to egg survival decreased rapidly on either side of the center line of the boat. Horton reviewed other studies which had proposed pressure waves under passing power boats as a detriment to egg and alevin survival, but could not confirm this hypothesis in his field testing. The species studied was sockeye salmon and the substrate in the study stream was generally small with 87 percent reported between 1 and 50 mm in diameter.

The effects of boat traffic on survival, stress, habitat choice and susceptibility to predation of juvenile salmonids was studied on the Rogue and Chetco rivers in Oregon (Satterthwaite 1995). No stranding or other direct mortality was found. Stress indicators increased when power boats were passed through side channels, but not in the main channels where most boat traffic usually occurs. Some juvenile salmonids were displaced by boats passing directly overhead, but few fish

showed behavioral response to boats passing at a lateral distance of 5 m or more. The juvenile salmon were more likely to show a behavioral response to an oar powered drift boat or kayak than power boats, but the reaction responses were more pronounced among fish displaced by power boats passing directly overhead.

Wading by anglers has been identified as a potential impact on salmonid spawning habitat or the survival of eggs and alevins while incubating in the gravel. Laboratory simulations of trout eggs in artificial redds have indicated potential for serious mortalities when anglers wade over redds containing developing eggs and fry, with pre-emergent fry being especially sensitive to wading pressure (Roberts and White 1994). Mortalities of up to 96 percent were reported by twice-daily wading every day of the development period and a single wading event timed just before eggs hatched killed 43 percent of the embryos in the test. Brown, rainbow and cutthroat trout eggs were used in the test. The gravel substrate used was fairly small, with 70% less than 38.10 mm in diameter, and uniformly mixed. Trout eggs were buried 15.5 cm deep in 25 cm of gravel placed in concrete tanks. The wading test consisted of a 75 kg wader stepping directly on the eggs that were confined in a 15.5 by 31.0 cm enclosure.

Generally, anadromous salmon and steelhead choose larger substrate and bury their eggs deeper in the gravel than do resident trout. Briggs (in Healey 1991) reports chinook eggs buried 20 to 36 cm deep (average 28 cm), while other studies reported eggs buried 10 to 80 cm depending on substrate and intergravel flows. Bell (1990) suggests 3/4 to 4 inch gravel (18 mm to 100 mm) as preferable for most salmon spawning. The redd building and spawning activity flushes fine sediment from the redd and leaves larger gravel particles with larger and more open interstices where the eggs are deposited. Healey (1991) reports redds with large cobble left in the areas where eggs are to be deposited after the redd digging activity has removed fine sediment and smaller gravel. Cleaning the gravel of finer particles and sorting the larger gravel into the egg deposition area provides larger interstices for the eggs, improves intergravel water flows to irrigate the incubating eggs and creates a more stable formation than uniformly graded gravel. These factors of natural spawning should make the eggs of naturally spawning salmon less susceptible to disturbance or crushing by wading anglers than were the trout eggs in the laboratory test. Spring/summer chinook spawn in late summer and the spawning rivers are frozen during much of the incubation period. Steelhead spawn in the spring at the start of spring runoff and most of the egg incubation takes place in high flows before the opening of general fishing season. Many of the most important spawning and rearing areas where natural-origin, listed, salmon and steelhead spawn are outside the proposed fishery areas, and the presence of wading anglers in very unlikely during the incubation period. However, there are some circumstances where certain types of angling activity could impact some redds.

Spring chinook spawn on shallow riffles in the headwaters of the Methow River during the time these waters are open to trout fishing and anglers could wade into redds. Spring chinook eggs incubate in the gravel during the spring, but no steelhead fisheries are proposed during this time period.

Habitat impacts of fishing activities are usually localized and short-lived and are not likely to have biological significance at the population or ESU level. Neither research reporting on boat use nor studies of wading impacts have identified population-level impacts or concluded that the angler activity was a factor of decline or a limiting factor to the affected populations. However, because local areas or individual redds may be destroyed or damaged it is incumbent upon agencies that propose fisheries in waters that support listed fish, to monitor the effects of fishing activities and to strive to reduce detrimental impacts through either educational or regulatory means.

In discussing the management implications of angler wading in spawning areas, Roberts and White (1994) recommended that wading should only be restricted in areas where trout are limited by degraded or insufficient spawning habitat or where intense angler wading occurs in spawning areas during the development of eggs and pre-emergent fry. Horton (1995) concluded that overall impacts of boat operation on habitat or spawning success was not likely to be great, but recommended that power boat use be restricted if specific exposure of spawning areas to boat traffic is identified. Satterthwaite (1995) concluded that additional restrictions on boat use would not increase production of salmonids in the study area, but recommended the management agencies continue to review the literature on boating impacts and refine management to avoid potential impacts on incubating eggs and alevins.

B. Analysis for effects of the action

The analysis of effects of this action is organized by fishery, then summarized for each ESU as a whole. For the fisheries with the greatest potential for take of listed species, this organization also reflects the general geographic distribution of populations.

1. Methow River catch-and-release trout fishery

The catch-and-release trout fishery is proposed to take place between June 1 and September 30, annually. Waters outside areas with anadromous fish will be open June 1 through October 31. In all areas, because of high flows during the spring, fishing rarely occurs before July. The WDFW estimates that angler effort will be approximately 7,200 angler days, based on an average participation of one angler per mile applied to the 60 miles of stream open to the proposed fishery, and 120 days in the fishing season. The WDFW estimates total annual catch by assuming an average of two fish per angler per day, for a total of 14,400 fish of all species.

Listed spring chinook salmon may be taken incidentally in this fishery. However, in the Methow River basin, spring chinook spawn upstream of the fishery areas, primarily upstream of the Chewuch River mouth and in upper areas of the Twisp, Chewuch, and Lost Rivers. Because spring chinook adults will have moved into spawning areas upstream of the fishery area before fishing occurs, and because spring chinook are relatively insusceptible to the gear used by trout anglers, no more than one listed spring chinook adult is expected to be caught each year, with no mortalities expected because live release is required. The potential take of juvenile spring

chinook is calculated from the anticipated proportion of chinook salmon in the catch, based on test fishery results for 1990, the most recent available data. Applying 1990 data after adjusting for reduced hatchery steelhead releases, as described in the permit application, juvenile spring chinook salmon are estimated to represent approximately 6% of the catch, or approximately 870 juvenile spring chinook (14,400 × 6% = 864). Applying a 5% mortality rate incidental to catch-and-release indicates a total annual mortality of approximately 44 juvenile chinook salmon in this fishery. This would equate to approximately 0.26 adult spring chinook salmon equivalents assuming 40% overwinter mortality and 1.5% smolt to adult survival (Ford et al. 1999).

Listed steelhead may also be taken in the Methow trout fishery. In the past, fisheries in the Methow River subbasin included effort directed at steelhead in addition to resident trout fisheries. The steelhead fishing occurred primarily near the mouth of the Methow River. In these fisheries during the 1992-1995 period, an average of 234 adult steelhead were caught annually, 18 of them in the area of the proposed fishery. The currently proposed fishery does not allow gear directed at steelhead, and is not open near the river mouth when adult steelhead would be arriving in the basin in September. The fishery closes the end of September before the peak of the steelhead run in the Methow River.

If an adult steelhead is incidentally caught in the Methow River trout fishery, the best available scientific information suggests hook and release mortality of adult steelhead will be low. Hooton (1987) found catch and release mortality of adult steelhead to be 3.4% (n= 3,715 fish) on average when using a variety of fishing tackle, including barbed and barbless hooks, bait and artificial lures. Reingold (1975) showed adult steelhead hooked, played to exhaustion, and then released returned to their target spawning stream at similar rates to steelhead not hooked or played to exhaustion. The WDFW anticipates effort levels no greater than half the recent historical effort, and estimates an annual catch of 10 adult steelhead in the proposed fishery, with less than 1 mortality annually as a result of a 5% incidental catch-and-release mortality.

The take of juvenile steelhead is impossible to calculate with any precision, due to the lack of knowledge concerning the proportion of rainbow trout relative juvenile steelhead resulting from anadromous parents in the catch. The NMFS emphasizes the need to collect this stock composition information for the Methow River in order to better evaluate the effects of the trout fishery, and a sampling plan designed to determine the likely proportions of steelhead in the trout catch has been included in the permit application (see below). Until more definitive information is available, only a range of anticipated impacts can be assumed. Approximately 250,000 listed hatchery steelhead of Wells stock origin are scheduled for annual release. The permit application cites information indicating that approximately 3 percent of hatchery steelhead in the area are represented by precocious males, and another 2 percent successfully overwinter. Therefore, approximately 12,500 hatchery steelhead could be expected to be present during the proposed fishery (250,000 × 5%). Based on 1990 hook-and-line test fishery results, adjusted for reduced hatchery release numbers currently compared to 1990, steelhead juveniles of hatchery origin are expected to represent approximately 21% of the catch, or 3,000 fish. The WDFW estimates that 12,500 *O. mykiss* are likely to be caught in the proposed fishery. After subtracting the estimated

3,000 hatchery-origin steelhead, 9,500 additional *O. mykiss* remain, of unknown composition (either resident trout or juvenile steelhead). If all 9,500 fish are resident trout, no additional steelhead take would occur. If all 9,500 fish were naturally-produced steelhead, then take would be 9,500 and approximately 475 mortalities would result incidental to live release. Therefore, the estimated take of listed juvenile steelhead in this fishery is 3,000 juveniles of hatchery origin (with 150 mortalities), and between 0 and 9,500 juveniles of natural origin (with 0-475 mortalities). If it is assumed that all of the *O. mykiss* caught and released are in fact steelhead (worst case scenario), this level of mortality would likely equate to 1.9 adult steelhead equivalents using 50% overwinter mortality for juveniles and the average smolt-to-adult survival from 1985-1997 of 0.82%.

The regulations proposed for the Methow River trout fishery are to allow no retention of any fish and use only artificial flies and lures with a single, barbless hook. Based on the available scientific literature, these regulations will likely result in the lowest impact to listed species while still allowing some angling opportunity. Many studies have shown trout mortality to be significantly lower when using artificial lures and/or flies than when angling with bait (Taylor and White 1992; Schill and Scarpella 1995; Mongillo 1984; Wydoski 1977; Schisler and Bergersen 1996). Wydoski (1977) showed the average mortality of trout when using bait to be more than four times greater than the mortality associated with using artificial lures and flies. Taylor and White (1992) showed average mortality of trout to be 31.4% when using bait versus 4.9% and 3.8% for lures and flies, respectively. Schisler and Bergersen (1996) reported average mortality of trout caught on passively fished bait to be higher (32%) than mortality from actively fish bait (21%). Mortality of fish caught on artificial flies was only 3.9%. Most studies have found little difference (or different results) in the mortality associated with using barbed versus barbless hooks, single versus treble hooks, and different hook sizes (Schill and Scarpella 1997; Taylor and White 1992; Mongillo 1984).

The overall impact from recreational fishing should be considered and assessed at the population level. Since it is very unlikely that every fish in the Methow River basin will be caught, overall mortality rates are substantially lower than reported above. For example, if 50% of the entire *O. mykiss* population in the Methow River is caught and released (very unlikely) with a 5% catch-and-release mortality rate, the overall impact from fishing would be 2.5%. If only 10% of the population is caught, overall mortality would be 0.5%. Since a substantial resident population of *O. mykiss* exists in the Methow River Basin (WDFW 2000), not all of the rainbow trout caught would be juvenile steelhead. If less than 50% of the *O. mykiss* caught were juvenile steelhead, overall impacts from this catch and release fishery would likely be much less than 1.2% using the encounter rates specified above (i.e. 50% x 5% x 50% = 1.2%; 10% x 5% x 50% = 0.2%).

2. Mainstem Columbia River summer/fall chinook fishery

The mainstem recreational summer/fall chinook fishery is proposed to occur from August 1 to October 31, with effort focusing on the area around the mouth of the Wenatchee River and just below Rocky Reach Dam. The primary opportunity for summer/fall chinook harvest occurs

during two to three weeks around the middle or latter part of September. Closing the fishery on October 31 is expected to reduce impacts on steelhead in November and December, when most chinook salmon have left the area. WDFW estimates effort in this fishery to be approximately 1,500 to 3,000 angler trips annually, with approximately 0.10 to 0.20 chinook caught per angler trip. Total catch of summer/fall chinook would therefore range from 150 to 600 fish per year.

Adult spring chinook are not expected to be taken during recreational fisheries for summer/fall chinook in the mainstem Columbia River, since the proposed fishery would occur after adult spring chinook have left the mainstem for spawning grounds in upper areas of tributaries. Juvenile spring chinook are also not expected to be taken in this fishery because juvenile spring chinook generally do not rear in the mainstem and are not susceptible to the type of gear used.

The proposed mainstem fishery is expected to only have a low effect on listed steelhead. WDFW conservatively estimates a total take of 25 hatchery and wild steelhead with an associated 10% incidental catch-and-release mortality rate resulting in less than 3 steelhead mortalities. Since the proportion of wild steelhead in the run is approximately 15% (Table 4), the 3 steelhead mortalities will probably not be fish of wild-origin. These impacts are likely to be distributed among steelhead returning to each of the natural production areas. No take of juvenile steelhead is expected to occur because juvenile steelhead are not likely to rear in the fishery area and are generally not susceptible to the type of fishing gear used.

3. Icicle Creek spring chinook fishery

Spring chinook salmon returning to Leavenworth National Fish Hatchery (NFH) are derived from a non-indigenous broodstock and are therefore not listed under the ESA. The hatchery is located on Icicle Creek, approximately three miles upstream of the mouth. Icicle Creek flows into the Wenatchee River at river mile 26. In past years, a recreational fishery has taken place in the Wenatchee River downstream of the mouth of Icicle Creek, as well as in Icicle Creek itself. However, in recent years the recreational fishery and an associated tribal fishery have been restricted to Icicle Creek, in order to minimize impacts to listed spring chinook in the subbasin. The fishery takes place in Icicle Creek between the mouth and the hatchery collection facility.

Listed UCR spring chinook return to the upper Wenatchee River and are not known to spawn or rear in Icicle Creek. Analysis of scales taken from spring chinook harvested in past Icicle Creek fisheries indicate that all of the fish sampled have been of hatchery origin. However, there have been rare recoveries of naturally-produced spring chinook in Icicle Creek, so the possibility that listed chinook salmon may be taken in the fishery must be considered. In 1997, three carcasses of Chiwawa-stock spring chinook were found in Icicle Creek during spawning ground surveys–these recoveries expand to approximately eight total adults. In each of 1994 and 1998, one naturally-produced spring chinook arrived at the hatchery. These observations indicate that listed spring chinook do occur in Icicle Creek, but apparently sporadically. While the likelihood is low that any listed spring chinook will be taken in the Icicle Creek fishery between 2000 and 2004, the fishery regulations assume that any spring chinook taken in the fishery are of Carson

stock origin, and allow the retention of all caught spring chinook. Therefore, any take of listed fish in this fishery would be lethal.

Based on recent historical catch and abundance information from Icicle Creek, the likely take of listed UCR spring chinook in the Icicle Creek fishery is in the range of 0 to 8. This estimate, while conservative, could change if the abundance of listed hatchery or natural-origin fish changes appreciably relative to the number of non-listed hatchery-origin fish returning to Leavenworth Hatchery. This change could occur if environmental conditions alter survival in any of several life-cycle stages. The composition of spring chinook returning to Icicle Creek could also change if high flows in the Wenatchee system lure naturally-produced chinook into Icicle Creek. Since most Carson-stock chinook are already returning to Icicle Creek, high water would tend to increase the proportion of naturally-produced fish in the creek, and therefore increase the likelihood of take of listed fish in the fishery. High flows occurred in 1997, so the range of take (0 to 8 fish) calculated above includes this scenario. The number of naturally-produced spring chinook in Icicle Creek may increase if on-going recovery efforts in the upper Wenatchee River are successful. Listed spring chinook in the upper Wenatchee River are currently being artificially propagated by WDFW in the Chiwawa River, Nason Creek, and the White River. These programs are intended to eventually increase the number of spawners returning to natural production areas. Other spring chinook populations (i.e Methow and Entiat populations) in the ESU would not be affected by this fishery.

NMFS is currently evaluating hatchery programs in the Upper Columbia River. One of the changes required in the Biological Opinion is to externally mark more of the spring chinook released from Leavenworth Hatchery. In the recent past, only 12% of the spring chinook released from Leavenworth were externally marked. In the future, more than 50% of the spring chinook will be externally marked. Externally marking a higher proportion of the spring chinook at Leavenworth Hatchery will help facilitate the evaluation of the incidental catch of listed spring chinook in the Icicle Creek fishery in the near future.

Steelhead are present in Icicle Creek, and could be taken in the spring chinook fishery. Steelhead were raised and released from Leavenworth NFH through 1997, and WDFW suspects that the majority of steelhead caught in the Icicle Creek fishery are of hatchery origin. The last returns of this program will be in 2001, with the return of three-ocean fish.

Regulations would require the immediate release of any steelhead caught in this fishery. In 1990-1994, during interviews by WDFW of 2,641 anglers, no steelhead were reported taken. In 1999, 122 anglers were interviewed, and no steelhead take was reported. This fishery occurs in May and June, which minimizes the potential take of listed adult steelhead because steelhead have already spawned. WDFW conservatively estimates that 15 to 20 adult steelhead may be taken annually in this fishery. All of the fish are likely to be spawned-out kelts. In order to account for the potential mistaken retention of some steelhead misidentified as salmon, WDFW applies a 10 percent mortality rate to the estimated catch of 20 fish, resulting in the annual estimated mortality

of 2 adult steelhead. Because of the type of gear used in the chinook fishery, no take of juvenile steelhead is expected.

4. Whitefish fishery

The whitefish recreational fishery occurs during the winter period when adult chinook are not present. No adult chinook take is thus anticipated during this fishery. Juvenile spring chinook are present during the winter, but are generally inactive or buried in the substrate during the day due to cold water temperatures.

The WDFW estimates an angler effort of 250 angler days during this fishery, distributed throughout the upper Columbia River basin, primarily on the Methow and Wenatchee rivers. Based on angler surveys during 1998, WDFW estimates a take of 15 adult steelhead (hatchery- and wild-origin) in the whitefish fishery throughout the basin. Applying a 5% catch-and-release mortality rate indicates that total mortality will be less than one adult steelhead annually. This take is expected to be distributed throughout the basin, primarily in the lower section of the Wenatchee River and on the Methow River near Winthrop, where much of the effort is expected to occur. No impacts to juvenile steelhead are expected, due to the low effort levels, the distribution of that effort across the basin, and the type of gear used in the fishery.

5. Smallmouth bass, walleye, and sturgeon recreational fisheries

No impacts to listed spring chinook or steelhead are anticipated in recreational fisheries of the upper Columbia River Basin targeting bass, walleye, or sturgeon. Smallmouth bass fishers concentrate in shallow water habitat in backwater areas where chinook and steelhead do not usually occur. Walleye fishing takes place when spring chinook are largely not present, and records indicate that few or no steelhead impacts occur. Sturgeon fishers use large gear and fish on the bottom of deep water areas where chinook and steelhead do not occur.

C. Summary of the Effects Analysis

Recreational fisheries in the upper Columbia River Basin in 2000-2004 proposed by WDFW are expected to take approximately 870 juvenile and 9 adult listed spring chinook, and up to 12,500 juvenile and 70 adult listed steelhead annually (Table 5). Most take will be non-lethal, with mortalities accruing incidental to live release of fish during non-retention fisheries. The largest source of mortality to listed steelhead would result from fisheries in the Methow River, and is largely dependent upon the proportion of juvenile steelhead caught in fishery otherwise targeting adult resident trout. As specified in the worse case analysis provided in the effects section, mortalities of juvenile steelhead from the Methow River trout fishery could result in the reduction of future adult escapements by up to two adult steelhead equivalents per year. No other rainbow trout fisheries are proposed in other steelhead production areas within the ESU (i.e. Wentachee, Entiat, Okanogan subbasins). No impacts to listed fish are expected as a result of other sampling and survey efforts, which include creel surveys and interviews with anglers.

Table 5. Authorized annual take level of ESA-listed species as a result of recreational fisheries implemented by the Washington Department of Fish and Wildlife in the Columbia River Basin upstream of Priest Rapids Dam, 2000-2004.

Fishery	Upper Columbia River spring chinook				Upper Columbia River steelhead †			
	Juvenile		Adult		Juvenile*		Adult	
	Take	Mortality	Take	Mortality	Take	Mortality	Take	Mortality
Methow River trout fishery	870	44	1	0	3000 (h) 0-9500 (n)	150 (h) 0-475 (n)	10	1
Mainstem Columbia River summer/fall chinook fishery	0	0	0	0	0	0	25	3
Icicle Creek spring chinook fishery	0	0	8	8	0	0	20	2
Whitefish fishery	0	0	0	0	0	0	15	1
Smallmouth bass, walleye, and sturgeon fisheries	0	0	0	0	0	0	0	0
TOTAL (worst case scenario)	870	44	9	8	12,500	625	70	7

† h:hatchery-origin; n:natural origin

*estimates are for all *O. mykiss*, which likely includes a significant portion of resident, non-anadromous rainbow trout

The WDFW has gone to great lengths to design fisheries which minimize the take of listed species. The take of listed spring chinook in the fisheries is relatively small and expected to take a total of 9 adult spring chinook. Eight of these adults are expected to be taken lethally in the Icicle Creek fishery, but this estimate is quite conservative, based on a single year's return to spawning grounds, and in the face of multiple years of no known take of spring chinook. Nine spring chinook represent 2% of the 1996-2000 average return, 0.6% of the 2000 return, and 0.6% of the Cautionary Abundance level. The other two spring chinook salmon populations (i.e. the Entiat and Methow) would not be affected.

The anticipated incidental take of juvenile steelhead in the Methow Basin can be viewed in terms of anticipated adult returns. The WDFW references smolt-to-adult return rates of approximately 0.78 percent for the upper Columbia River. At this rate, if the Methow trout fishery did not occur, the 625 juvenile steelhead estimated killed as a result of the fishery would be expected to return 5 adult steelhead, or 0.2 percent of the 1994-1998 average count at Wells Dam. This is the maximum level of adverse impact based on the available information, and assumes that all the *O. mykiss* taken in the fishery are juvenile steelhead. In reality, the total annual take is somewhere

between 0 and 0.2 percent of the Wells Dam count. The Wells Dam count consists of steelhead returning to the Methow River and Okanogan River, so impacts will be less than 0.2 percent.

To put these levels of impact into perspective, it is pertinent to recall the current state of the species. As described previously, the biological requirements of the Upper Columbia River spring chinook and steelhead ESUs are not currently being met. Were the fisheries considered in this Opinion not to occur, the additional adults escaping to spawning areas would be less than 5 fish. This increase in escapement is not likely to result in a change in the overall population trends. When considering each ESU as an aggregate, improvements in the status of the ESU is expected to come primarily from actions taken in other sectors. In all of the fishery areas, the incidental take anticipated represents a small portion of the total adult return in any given year.

Take of listed species resulting from recreational fishing activities, other than those related to the actual catch or harvest of fish, including wading, walking on stream or lake banks, and boating, is difficult to quantify. Wading anglers can cause high mortality of developing salmonid eggs and fry, particularly during late stages of egg development and the sac fry stage (Roberts and White 1994). Boating may disturb spawning salmonids, may disturb redds and may create a take of listed species through harassment. Trampling or removal of riparian vegetation may occur in localized areas from anglers accessing streams. However, the measurable incidental take from fisheries results from the actual catch of listed species. Proposed levels of take reflect estimates of impacts from the actual catch of listed species, with the assumption that disturbance effects are minimal.

VI. Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." The action area defined in this consultation includes the mainstem Columbia River and tributaries upstream of Priest Rapids Dam.

Most of the spawning and rearing of listed spring chinook and steelhead occurs in the tributaries to the Columbia River (Busby et al. 1996; Bugert 1997; Ford et al. 1999). This habitat is predominantly on federal lands (Figures 1 and 2). Significant improvement in the survival of spring chinook and steelhead in non-federal land areas is likely to come from changes in the operation of hydropower facilities and instream flows in the mainstem Columbia River. NMFS is currently in consultation with the Corps., BPA, and the FERC on the operation of the hydropower dams in the Columbia River Basin. NMFS assumes that these consultations will result in stream flows, dam passage conditions, and other habitat conditions that are more beneficial for the survival and recovery of listed fish than in the past.

For actions on non-Federal lands which the landowner or administering non-Federal agency believes are likely to result in adverse effects to spring chinook, steelhead, or their habitat, the landowner or agency should work with NMFS to obtain the appropriate ESA section 10

incidental take permit, which requires submission of a habitat conservation plan. If a take permit is requested, NMFS would likely seek project modifications to avoid or minimize adverse effects and taking of listed fish.

Therefore, as stated above, most of the significant factors for decline of listed salmon and steelhead in the Upper Columbia are being addressed through Federal activities and consultations. At this time, NMFS is not aware of any future new (or changes to existing) State and private activities within the action area that would cause greater impacts to listed species than presently exists.

VII. Integration and Synthesis of Effects

NMFS has proposed to issue a permit to WDFW for recreational fisheries in the Upper Columbia River Basin which are anticipated to take approximately 870 juvenile and 9 adult listed spring chinook, and up to 12,500 juvenile and 70 adult listed steelhead annually. Most take will be non-lethal, with mortalities accruing incidental to live release of fish during non-retention fisheries. Losses of Upper Columbia spring chinook are expected to be focused in the Icicle Creek chinook fishery and are anticipated to reduce numbers of spawning adults by up to 8 adult spring chinook per year. Effects of these mortalities include a reduction in the number of adult spawning chinook contributing to the survival and recovery of this species by precluding their ability to spawn and provide for future returns generations of chinook. Effects may also include loss of nutrients which would have been provided by post-spawning adults. Based on a estimated abundance of adult spring chinook returning to spawning areas (Tables 2 and 3), mortalities of up to 40 adult spring chinook anticipated over this life of this permit (5 years) are not expected to result in appreciable reductions in the reproductive success, population size, or distribution of spring chinook. Likewise, mortalities of adult steelhead are anticipated to include up to 7 adults per year from the Methow River trout, Mainstem Columbia River summer/fall chinook, Icicle Creek spring chinook, and whitefish fisheries. Based on a estimated abundance of adult steelhead returning to these spawning areas (Tables 3 and 4), the losses of up to 35 adult steelhead over the life of this permit are not expected to represent an appreciable reduction in the reproductive success, population size, or distribution of Upper Columbia steelhead.

The largest source of mortality to both Upper Columbia juvenile steelhead and Upper Columbia River juvenile spring chinook would result from fisheries in the Methow River, and is largely dependent upon the proportion of juveniles caught in fishery otherwise targeting resident trout. As specified in the worse case analysis provided in the effects section, mortalities of up to 44 juvenile spring chinook, and up to 625 juvenile steelhead are anticipated. NMFS has estimated that the loss of these juvenile fish could have the long-term effect of reducing future adult escapements of steelhead to the Methow River by an additional two individuals per year. The total reduction in adult steelhead escaping to spawning areas of the Methow River over the life of this permit (5 years) due to juvenile mortalities (using the assumptions specified in the effects section) is anticipated to be up to 10 Upper Columbia River steelhead.

The effects of these losses of adult spawning fish in the Upper Columbia River would occur later in time than the 70 adult steelhead anticipated to be caught and released in all of the fisheries each year, and will be reflected in reduced returns of spawning adults to the Methow River beginning in 2003/2004. These losses may further depress the numbers of natural origin steelhead returning to the Methow River, and extend the duration of the effects of the mortalities associated with issuance of this permit.

Anglers in the headwaters of the Methow River may incidentally harm spring chinook redds and adversely affect critical habitat by wading in streams, with boat operations, or trampling or removing vegetation. Individual redds could be destroyed or damaged if anglers are not advised of the potential for harm during these activities. Since WDFW's conservation plan includes an education program for anglers fishing in sensitive areas and because the fishing season closes before the majority of chinook salmon spawning occurs, NMFS expects that damage to individual redds and critical habitats will be minimized. Critical habitat for steelhead, and steelhead redds are less likely to be harmed by these activities since the fishery does not occur during steelhead spawning and egg incubation. Based on available information provided in the effects analysis, and WDFW's commitment to educate anglers fishing in these areas, NMFS believes that any adverse habitat effects to critical habitat or individual redds associated with these fisheries will be minimized and unlikely to be measurable in the long-term.

Overall, worse case estimates for fisheries proposed by WDFW between 2000-2004 include reductions in numbers of up to 40 adult spawning spring chinook, and 220 juvenile spring chinook; and up to 35 adult spawning steelhead, and 3,125 juvenile steelhead over the life of the permit. While these effects will reduce the number of spawning adults, and the potential for this species to increase adult returns in the long-term, NMFS does not believe that these reductions will appreciably reduce the numbers, distribution or reproductive success spring chinook or steelhead in the action area. Additional harm of listed species could occur due to wading, boating, and walking on stream banks, but these adverse effects are expected to be minimal.

NMFS has reviewed current status, environmental baseline, and cumulative effects and believes it is reasonable to conclude that the mortalities associated with the issuance of WDFW's permit are not likely to appreciably reduce the reproductive success, population size, or distribution of Upper Columbia River spring chinook or Upper Columbia River steelhead. NMFS concludes that issuance of this permit to is not expected to reduce appreciably the Upper Columbia River spring chinook or Upper Columbia River steelheads' likelihood of survival and recovery in the wild.

VIII. Conclusion

After reviewing the current status of Upper Columbia River spring chinook and Upper Columbia River steelhead, the environmental baseline for the action area, the effects of the fisheries proposed by WDFW, and the cumulative effects, it is NMFS biological opinion that the issuance of a section 10(a)(1)(B) permit to WDFW for annual incidental takes associated with the conduct

of recreational fisheries in the state of Washington in the Columbia River and its tributaries as proposed, is not likely to jeopardize the continued existence of Upper Columbia River spring chinook or Upper Columbia River steelhead, and is not likely to destroy or adversely modify designated critical habitat.

IX. Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibits the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The terms and conditions outlined in section II are non-discretionary; they must be undertaken by the action agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The action agencies have a continuing duty to regulate the activity covered in this incidental take statement. If the action agencies (1) fail to assume and implement the terms and conditions or (2) fail to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the agencies must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement [50 CFR §402.14(i)(3)].

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

A. Amount or Extent of Take Anticipated

The recreational fisheries in the upper Columbia River Basin proposed for 2000-2004 considered here are expected to take up to 9 listed adult spring chinook, 870 listed juvenile spring chinook,

70 listed hatchery- and natural- origin adult steelhead, and 9,500 listed hatchery- and natural-origin juvenile steelhead, annually.

This take is expected to result in the annual mortality of no more than 44 listed juvenile spring chinook, 8 listed adult spring chinook, up to 150 listed hatchery-origin juvenile steelhead, up to 475 listed natural-origin juvenile steelhead, and 7 listed adult steelhead. These mortality levels are worst case scenarios that are not likely to occur, especially for juvenile steelhead. See the analysis of effects above for further information.

No impacts are expected as a result of monitoring and evaluation programs associated with these fisheries.

B. Effect of the Take

In this Opinion, NMFS has determined that the level of anticipated take is not likely to jeopardize the continued existence of Upper Columbia River spring chinook or Upper Columbia River steelhead or result in the destruction or adverse modification of designated critical habitat. NMFS' policy on recreational fishing recognizes the potential for conflict between the conduct of recreational fisheries and administration of the ESA, and supports the development of adequately protective management measures to resolve such conflicts.

X. Reinitiation of Consultation

This concludes formal consultation on NMFS' issuance of a section 10(a)(1)(B) permit to WDFW for the conduct of recreational fisheries in the Upper Columbia River. As provided in 50 CFR §402.16, reinitiation of consultation is required where Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of take specified in the permit is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (3) the action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in the biological opinions, (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, NMFS must immediately request reinitiation of consultation. Any court settlement that addresses harvest sharing in the Columbia River Basin and affects the terms of this permit may be considered as new information.

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